SOUTHWESTERN

RANGE & SHEEP BREEDING LABORATORY

FORT WINGATE, NEW MEXICO

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH SERVICE

COOPERATING WITH THE

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF INDIAN AFFAIRS

AND THE

NEW MEXICO AGRICULTURAL EXPERIMENT STATION

1957-58 20 REPORT

THIS REPORT OF RESEARCH PROJECTS NOT YET COMPLETED IS INTENDED FOR THE USE OF ADMINISTRATIVE LEADERS AND WORKERS IN THIS OR RELATED FIELDS OF RESEARCH, AND NOT FOR GENERAL DISTRIBUTION.

ROSTER OF PERSONNEL

3111D

Name	Title	Date Entered on Duty	Duties
Stanley L. Smith	Animal Husbandman	July 23, 1952	Director
George M. Sidwell [1]	Animal Husbandman	Dec. 1, 1946	Genetics
Gordon L. Jessup, Jr.[2]	Animal Husbandman	Mar. 17, 1952	Sheep Investigations
Jack L. Ruttle	Animal Husbandman	Aug. 26, 1957	Sheep Investigations
Alison S. Dodge	Clerk (Stenography)	June 3, 1951	Clerical
Glenn C. Perkins	Farm Foreman	Sept. 24, 1954	Operations
Jimmie Gleason	Maintenance Man	Apr. 1, 1942	Maintenance
Fred Deschene	Labor Leader	Oct. 2, 1947	Camp Tender
Calvin Gleason	Laborer	Sept. 4, 1956	Miscellaneous
Sam Martinez	Animal Caretaker	Apr. 9, 1956	Sheepherder
Kee Cayateneto	Animal Caretaker	Aug. 4, 1957	Sheepherder

1. Dr. George M. Sidwell transferred July 1, 1958 to the Agricultural Research Center, Beltsville, Maryland.

2. Gordon L. Jessup, Jr. in leave without pay status effective September 21, 1957 in order to pursue graduate studies at Oregon State College, Corvallis, Oregon.

OBJECTIVE

This laboratory is maintained for the primary purpose of developing a type of sheep suitable for Southwestern range conditions. Through selection based on production records it is hoped to develop an animal that is adapted to the environment and will produce a maximum amount of lamb and wool. Production records considered involve weight of lamb and wool produced, body weight, and suitability of wool for both hand-weaving and commercial manufacture. By selecting for these traits, a breeding method is employed that is suitable for other stockman operating in this area and under similar conditions.

OUTLINE OF RESEARCH PROGRAM

The research program of the Southwestern Range and Sheep Breeding Laboratory is divided into four projects. Three projects deal primarily with sheep breeding, while the fourth is concerned with investigations of wool and its various qualities. These four projects provide for maximum utilization of the sheep and the records obtainable from them. The four projects active at Fort Wingate during the years 1957 and 1958 are:

1. Improvement of Navajo sheep by linebreeding and selection within the Navajo strain. (APH b1-10)

2. Improvement of finewool sheep under Southwestern conditions. (APH b1-11)

3. Improvement of coarsewool sheep for the production of wool suitable for Navajo hand-weaving. (APH b1-12)

4. Investigations for wool for the improvement of Navajo, Navajo-crossbred, Targhee and Targhee-crossbred sheep under Southwestern Range conditions. (APH b5-6)

These projects are carried out under the United States Department of Agriculture Work Projects, ARS-b-2-1, Sheep Breeding Investigations, and ARS-b-2-6, Investigations of Wool and other Animal Fibers.
(NOTE: When reference is made to the above projects in the following sections of this report, only the number preceding the project title will be used.)

PUBLICATIONS

The following papers have been published since the establishment of the Southwestern Range and Sheep Breeding Laboratory:

1. The Navajo Sheep Industry and Needs for Its Improvement:
   J. M. Cooper, The Sheep Breeder, May, 1939.

2. The Sheep Industry of Indians in the Southwest:
   J. M. Cooper and Dewey Dismuke, Indians at Work, August, 1939.

3. Breeding for Adaptability to Local Conditions, with Special Reference to Sheep on the Navajo Indian Reservation:
   J. M. Cooper, American Society of Animal Production, 1939.

4. Improvement of the Navajo Sheep:
   Cecil T. Blunn, Journal of Heredity, March, 1940.

5. Breeding for Quality Wool:
   James O. Grandstaff, The National Wool Grower, July, 1940.

6. A Rapid Method for Projecting and Measuring Cross Sections of Wool Fibers:

7. Evaluating Fleece Characteristics of Navajo Sheep from a Breeding Standpoint:
   James O. Grandstaff, Rayon Textile Monthly, October-November, 1941.

8. Wool Characteristics in Relation to Navajo Weaving:
   James O. Grandstaff, Technical Bulletin No. 790, U. S. Department of Agriculture, January, 1942.

9. Characteristics and Production of Old-Type Navajo Sheep:
   Cecil T. Blunn, Journal of Heredity, May, 1943.

10. The Influence of Seasonal Differences on the Growth of Navajo Lambs:
    Cecil T. Blunn, Journal of Animal Science, February, 1944.

11. A Preliminary Report on the Post-Natal Development of the Fiber Characteristics of the Fleeces of Navajo Sheep:
    James O. Grandstaff and Cecil T. Blunn, Journal of Animal Science, May, 1944.

12. Comparison of the Yields of Side Samples from Weanling and Yearling Sheep:
    Cecil T. Blunn and James O. Grandstaff, Journal of Animal Science, May, 1945.

13. Yearly Differences in Growth of Navajo and Crossbred Ewe Lambs:
Cecil T. Blunn, Journal of Animal Science, August, 1945.

14. Eveluating Fleece Quality of Navajo Sheep from Small Samples:
James O. Grandstaff and Cecil T. Blunn, Journal of Agricultural Research, September, 1945.

15. Improvement of Wool for Navajo Hand Weaving:
James O. Grandstaff and Cecil T. Blunn, Indians at Work, March, 1945.

16. Relation of Kemp and Other Medullated Fibers to Age in the Fleeces of Navajo and Crossbred Lambs:
James O. Grandstaff and Harold W. Wolf, Journal of Animal Science, May, 1947.

17. Comparison of Corriedale x Navajo and Romney x Navajo Crosses:
James O. Grandstaff, Journal of Animal Science, November, 1948.

18. Size of Lambs at Weaning as a Permanent Characteristic of Navajo Ewes:
George M. Sidwell and James O. Grandstaff, Journal of Animal Science, August, 1949.

19. Adaptation of Livestock to New Environments:
James O. Grandstaff, for publication in Proc. United Nations Scientific Conference on Conservation and Utilization of Resources, Lake Success, New York, 1949.

20. Fertility and Reproduction in Sheep in Relation to Breeding and Environment:
James O. Grandstaff, presented at International Symposium on High Altitude Biology held at Lima, Peru, South America, November, 23-30, 1949.

21. Genetic and Environmental Factors affecting Staple Length in Navajo and Navajo Crossbred Weanling Lambs:
George M. Sidwell, James O. Grandstaff and Donald A. Price, Journal of Animal Science, February, 1951.

22. Lamb Production of Navajo Ewes Bred to Columbia and Romney Rams, and Navajo Crossbred Ewes Bred to Lincoln and Cotswold Rams:
Donald A. Price, James O. Grandstaff and George M. Sidwell, Journal of Animal Science, February, 1951.

23. Genetic and Environmental Factors Affecting Type and Condition in Navajo and Navajo Crossbred Weanling Lambs:
George M. Sidwell, Donald A. Price and James O. Grandstaff, Journal of Animal Science, May, 1951.

24. Effects of Some Genetic and Environmental Factors on Yearling Traits of Navajo and Navajo Crossbred Ewes:
Donald A. Price, George M. Sidwell and James O. Grandstaff, Journal of Animal Science, November, 1953.

25. Some Aspects of Twin Vs. Singly Lambs of Navajo and Navajo Crossbred Ewes:
George M. Sidwell, Journal of Animal Science, February, 1956.

26. Estimation of Clean Fleece Weight from Small Side Samples and from Wool Density, Body Weight, Staple Length and Grease Fleece Weight:
George M. Sidwell, Gordon L. Jessup, Jr. and W. D. McFadden, Journal of Animal Science, February, 1956.

27. Some Factors Influencing Fiber Diameter in Yearling Ewe Fleeces:
George M. Sidwell, Western Section Meetings of the American Society of Animal Production, Reno, Neveda, July 16-18, 1956.

28. A Comparison of Five Methods of Estimating Clean Fleece Weight:
George M. Sidwell, P. E. Neale and Gordon L. Jessup, Jr., Journal of Animal Science, August, 1958.

29. Tests Reveal Importance, Influence of Large Bodied, Weighty Ewes:
Jack L. Ruttle, The National Wool Grower, October, 1958.

SUMMARY OF PRECIPITATION

	Fort Wingate				El Morro		
	Average 1864-1911	Average 1938-1956	1957	1958	Normal	1957	1958
January	.96	.89	3.48	.64	.93	1.29	.31
February	1.42	.61	1.29	.69	.84	1.26	.79
March	1.02	.94	.88	1.28	1.18	1.15	1.69
April	.98	.62	.95	.94	.60	.55	1.04
May	.58	.62	1.15	.30	.41	1.17	.01
June	.69	.53	.59	.26	.53	.65	.50
July	2.34	1.80	4.04	1.14	1.80	3.05	1.26
August	2.31	2.02	3.06	3.08	2.76	2.72	1.86
September	1.37	1.10	.00	3.78	1.46	.02	1.56
October	1.05	.96	1.96	1.86	1.01	2.18	.74
November	.76	.64	.93	.42	.52	.76	.80
December	.97	.97	.32	.27	1.03	.65	.22
ANNUAL	14.45	11.70	18.65	14.66	13.07	15.45	10.78

The above table summarizes the precipitation at Fort Wingate and El Morro, New Mexico. El Morro data is presented because the ewes and lambs are grazed on El Morro range for a large part of the year and because there are sometimes appreciable differences in the amounts of precipitation between the two locations. Data at Fort Wingate from 1938 to the present have been compiled from Station records: all other data have been secured from the U.S. Weather Bureau reports.

WEATHER CONDITIONS

1957

For the first time since 1949, annual precipitation on a statewide basis was above long-term average. At Fort Wingate, 1957 precipitation totaled 18.65 inches. The 47-year, (1864-1911) average totaled 14.45, and the 19-year, (1938-1956) average amounted to 11.82 inches. At El Morro, the 1957 annual precipitation totaled 15.45 inches. During the growing season (May through September), Fort Wingate and El Morro received 8.84 and 7.61 inches of precipitation, respectively.

September and December were the two driest months of the year.

1958

Precipitation at Fort Wingate remained very slightly above average during 1958, totaling 14.66 inches; however total precipitation at El Morro where the ewes and lambs are grazed for the major portion of the year, amounted to only 10.78, whereas average normal rainfall for this location amounts to 13.07 inches.

The period from May through September brought almost as much precipitation as 1957, to Fort Wingate, but the major portion of this rainfall occurred in August and September, and was too late in the growing season to be of real benefit. July was the lowest on records since 1944, with a total precipitation of only 1.14 inches. The spring months were dry and extremely windy, although March had an above average total precipitation of 1.28 inches.

SUMMARY OF YEAR'S OPERATIONS - 1957

The year of 1957 began with the largest amount of precipitation ever to fall in one month being recorded for January. Precipitation totaled 3.48 inches for the month, of which 1.80 inches was rain and the remainder was from snow. This moisture was needed very badly since the ranges were extremely dry. Most of the moisture soaked into the ground with very little run-off, so that by February water had to be hauled to the sheep. Early in March it was necessary to begin feeding a supplemental ration to all laboratory sheep. This was in the form of a pellet containing 70 percent alfalfa, 20 percent milo and 10 percent molasses.

Scoring and sampling of all rams, yearling, and two year old ewes was done in April. Traits scored were: face covering, outer-coat, color, horns, jaw formation, and belly covering. Body weights were also taken at this time. Wool samples were taken from the side and thigh areas of all rams, yearling, and two year old ewes. These samples were measured for staple length and cross-sectioned to determine the average fiber diameter. Shearing in 1957 was delayed several days due to rain and snow. When shearing was completed all sheep were dusted with a 2% Dielring dust to control ticks. This method has proved to be fast, effective, and economincal. Sheep can be dusted at the rate of 80 head per minute, which requires approximately one pound of dust at this rate. At the current prices, it costs roughly six cents to dust 80 heads.

Lambing began immediately after shearing and was completed the last of May. Of 549 ewes lambing, there were 594 live lambs born. When the lambs were strong enough, they along with their mothers, were trucked back to the El Morro range, as a rule this done at approximately two weeks of age. Due to the extremely dry conditions on the El Morro range, moving of ewes and lambs was delayed until early July. During June, all sheep were vaccinated for Bluetongue and the lambs received an additional vaccination for Soremouth (contiagious Ecthyma) At the same time body weights, type and condition (fleshing) scores were taken on all rams, yearling, and two year old ewes.

Additional rain fell in July and resulted in partly filling the water tanks on the El Morro and Wingate ranges. Heavy rains in August completed filling the tanks and the outlook for both grass and water were excellent. Several old lake beds which had been dry for over ten years, now had water in them.

Scores, wool samples, and body weights were taken on weanling lambs early in September. Due to ample forage, the 1957 weanling lambs were the heaviest in several years. Many lambs approached the 100 pound mark. Dry weather in September brought about a good cure on the grass and plenty of fall grazing was assured. In October the laboratory flocks were culled. Lamb culling was based on the weights and scores taken in September. The ewes were culled largely on the basis of age and poor teeth. After culling, the entire laboratory herd was dusted for ticks. Semen testing of rams was done in November. Also in November a check was made to determine the effectiveness of Dow Chemical ET-57 previously given for the control of Head-grubs. This was done by opening the heads of seven culled ewes who had received the treatment for evidence of grubs. On the basis of this examination,

it was recommended to treat all ewes at beginning of breeding season in December.

The ewes were weighed, branded, and assigned to breeding pens in early December. A change from prior years was made in the 1957 breeding plans. In order to obtain additional information for research purposes, the ewes in the four reservation groups were pen-mated at the laboratory. In previous years the ewes of these groups were put into pens at night and enough rams to cover them were turned in. In 1957 this plan of breeding was dropped and the ewes were divided into pen of approximately ten ewes with one ram. This method of mating provides for use of more rams and afford additional information on the effect of sire on the lamb traits.

In December the ram lamb herd had an outbreak of Soremouth. The entire herd was infested even though all had been vaccinated in June. Some preliminary investigations were conducted to determine if a new or more virulent strain of the ecthyma virus was causing such outbreaks. No conclusions were reached as to the cause. The commercial producers of the vaccine began studies to determing the possibility of a new strain of virus.

SUMMARY OF YEAR'S OPERATIONS-1958

Breeding was completed in January and the ewes trucked back to the El Morro range. The rams were kept at the laboratory for four days before being moved to El Morro and placed with the ewes. The four days lapse allowed sufficient time between ewes lambing from the pen breeding and those that were bred on the range. While this cut down on the number of drys and upped the lambing percentage, it was not very satisfactory. The lambs from the range matings were useless for research purposes since nothing was known about the sire of the lambs. Also many lambs were lost that were born on the range. The range-mating also resulted in lambs being born all summer and having very little growth at weaning time in October. There was also the question of whether or not the late lambing ewes would settle again in December at regular breeding time. If not, this would result in a large number of dry ewes the following Spring. Because of the small, late lambs and possibilities of a high percentage of drys, it was decided to discontinue this practice of range breeding in the future.

In February the ewe lamb flock was hit by an outbreak of Soremouth. The ewe lambs had all been vaccinated for contagious ecthyma, but the outbreak still affected almost one-hundred percent of the flock. It is generally thought that Soremouth does not effect older sheep, but two year old ewes in the faboratory flock were effected. Scab material from the lesions on the infected lambs was harvested to be used by several research laboratories in in trying to determine the cause. While there was not a death loss from Soremouth, the resulting losses in weight from being unable to eat were serious. The disease will run its course in approximately 2-3 weeks, but the loss in weight is a definite set-back to the lamb.

By early March the ranges were exceedingly dry with little grass. It was necessary to start feeding 70 percent alfalfa pellets. The lambs received 1/4 pound daily and the mature rams and ewes 1/3 pound daily.

Body weights, scores, and samples were taken on all rams, yearling, and two year old ewes in April. Shearing was done in April and the fleeces were unusually clean and light shrinking. This same fact was true over much of New Mexico, with most commercial sheep enterprizes shearing the cleanest clip in a number of years. All fleeces were run through the Neale Squeeze Machine at shearing to get an estimate of clean wool content of each fleece. During the first day of shearing, a field day was held in cooperation with the Bureau of Indian Affaris. Approximately 170 persons attended to observe the various breeding groups and shearing operations. A large amount of interest was displayed in the Squeeze Machine.

Lambing begun the last of April with the majority of the lambs being dropped in early May. The ewes were in very poor condition, but had little difficult lambing. While the ewes seemed to have an ample supply of milk they were not very interested in mothering their lambs. The ewes were more interested in eating, rather than standing for the lamb to nurse. This situation was further aggravated a high percentage of twins being born. Approximately 20 percent of the ewes lambing had twins. This created a rather serious problem since the majority of the ewes were in poor conditions.

On June 18 and 19 the laboratory flock was vaccinated for Bluetongue with lambs receiving a vaccination for Soremouth at the same time. Along with vaccinating, June body weights and scores for type and condition were taken. The vaccinations for Soremouth were checked for "takes" about five days after vaccinating. This is in accorance with recommednations made by the commercial vaccine companies.

In July the laboratory rams were turned loose in a newly completed fenced pasture. Heretofore, the rams have always been herded, as are the rest of the sheep. In a few weeks a definite change was noticed in the rams. Though they were not weighed, it was evident that all had gained weight and presented a much better general appearance.

The 1958 lambs were weaned early in September. The averages weaning weight was almost ten pounds lighter than the 1957 average. This can largely be attributul to poor range conditions. The early Spring of 1958 looked very promising; however, lack of needed rainfall soon changed the picture. The South end of the El Morro range was completely devoid of grass by September. The small amount of rain received in late Agust and September were too late to produce grass for winter forage.

During the middle of September the lamb herds were checked for "takes" on a second Soremouth vaccination given at weaning time. The second vaccination was administered in the hopes of obtaining a 100% immunity and avoid another outbreak as occured in 1957.

The check made on the second vaccination found about 39 percent of the lambs showing a large scar at the site of vaccination. This indicates that only 61 percent were immumized with the first vaccination at one month of age. These observations suggest that a second vaccinationseach year would be beneficial.

The laboratory flocks were culled in October. Lamb culling was based on measurements and score taken at weanling age. The mature ewes culled consisted largely of broken or smooth-mouthed ewes, or those with spoiled bags and crippled limbs. A few ewes that were dry for two or more years were also culled. Semen testing began the latter part of October and was completed in mid-November. Speed of semen testing hinges largely on the weather conditions. Semen samples are obtained outside in an open pen and the semen is easily effected by temperature. In cold weather the temperature can cause a low motility score due to the cold shock when transferring the sample to the tes-tube. This results in the necessity of obtaining several extra samples from a ram showing low motility or poor semen. Several samples are needed to ascertain whether the ram actually has poor qulity semen or the semen was affected by cold shock.

The 1958 breeding pens were assigned in December. During the first week all ewes and rams to go into breeding pens were weighed and branded. Breeding plans were the same as 1957, with all ewes being pen-mated at the laboratory. Breeding season continues for 30 days, with ewes and rams coming out of the pens the first week of January. At completion of breeding, the ewes are trucked back to the El Morro range to remain until April.

OUTLINE OF BREEDING PROGRAM

Type of Breeding and Group Number		Breeding of Rams	Breeding of Ewes	Number of Ewes Breeding Season 1956-57	1957-58
Coarsewool	1	N	N	75	98
	16	$(K \times N) \times (C_2 \times \text{Crossbreds})$	$(R_1 \times N) \times (L \times \text{Crossbreds})$		
		$(R_1 \times N) \times (L \times \text{Crossbreds})$	$(K \times N) \times (C_2 \times \text{Crossbreds})$	75	112
		and Reciprocal crosses			
Finewool	13	T x Crossbreds	T x Crossbreds	75	107
Reservation	20	Res	Res	75	111
	21	R_2	Res	75	97
	22	T	Res	75	96
		$(K \times N) \times (C_2 \times \text{Crossbreds})$	Res		
		$(R_1 \times N) \times (L \times \text{Reossbreds})$			
Targhee	25	T	T	67	73
			Totals:	592	798

CODE OF SYMBOLS FOR BREEDS

C_1 - Corridale	L - Lincoln	R_2 - Rambouillet
C_2 - Cotswald	N - Navajo	Res - Reservation
K - Columbia	R - Romney	T - Targhee

(NOTE: The term "corssbreds" is used to disignate the original crossbred ewes upon which all lines have been based. It consists of the following matings:

$$(C_1 \times N) \times (R_1 \times N)$$
$$(R_1 \times N) \times (C_1 \times N)$$

SUMMARY OF BREEDING PROGRAM 1956-57

Due to the continued drought situation, the number of breeding ewes was reduced for the 1956-57 breeding season. The ranges were in such a depleted condition that a reduction was deemed necessary to stay within the available feed supply limits. All groups were reduced to 75 ewes each, except the Targhee group, which was allowed to remain at its present strength of 67 ewes. It was planned to build the groups back up to approximately 100 ewes each, when the grass is available and as replacements are raised. The breeding groups are associated with the research line projects as follows:

Breeding Group	No. of Matings	Line Project
1	75	1
16	75	3
13	75	2
20,21,22	225	2
23	75	3
25	67	2
Total:	592	

The 1957-58 breeding program was altered somewhat from previous years plans. Prior to 1957-58 breeding the reservation groups of ewes, which are 20, 21, 22, and 23 were pen-bred at night on the El Morro range. By this method, it was not possible to know the sire of the lamb from one of those pens. This was not satisfactory, since the sire side is important in studying traits of a lamb. It was decided then, to pen-bred the reservation group at the laboratory along with the other groups, 1, 13, 16, and 25. The reservation ewes were divided into ten pens of approximately ten groups, with the exception of group 21. This group is mated to Rambouillet rams obtained from the Navajo Tribal Ram Pasture at Sanders, Arizona. One of the ten rams obtained for this group, proved to have poor semen, and a replacement was not available, so only 9 pens were in group 21.

The remaining groups which had been reduced to 75 ewes each in 1956-57 because of drought, were strengthened with replacements from the 1956 lamb crop. The numbers in each group and their association with the research line projects were as follows:

Breeding Group	No. of Matings	Line Project
1	98	1
13	107	2
16	112	3
20	111	2
21	97	2
22	96	2
23	104	3
25	73	2
Total:	798	

MEASUREMENT, SCORING, SAMPLING AND SELECTION TECHIQUES

The procedures described in this section are employed at the Southwestern Range and Sheep Breeding in the collection of data on each individual sheep. These methods are followed as closely as possible so the data will be comparable from year to year.

Body weights are recorded for all rams, yearling and two year old ewes in April and June. The mature ewes and all rams are weighed each December, prior to being assigned to breeding pens. Lambs are weighed at birth and again at weaning time when they are approximately 120 days of age. Weaning weights are then adjusted for days of age, age of dam, type of rearing-whether single, twin, or a twin raised as a single. The adjusted weights are then considered when selections are made at culling. Factors used in adjusting body weights are as follows:

Type of Birth

Single	Twin		Twin raised as Single
-4.70	+6.50		-1.80

Age of Dam

(2)	+1.80	-2.90	+8.30	0
(3)	+1.50	-6.20	+5.00	-3.30
(4-7)	-1.70	-6.40	+4.80	-3.50
(8)	+1.40	-3.30	+7.90	-0.40

Age of weaning ∓ .37 lbs. per day for each day under or over 120 days of age.

An example of weight adjustment on a weanling lamb is an follows:

A twin lamb, born of a four year old ewe, and weighing 56.00 lbs. at 125 days of age, would have an adjusted weight of 58.95 lbs.

Example

Actual weight.....	56.00
Born of a four year old ewe, Rasied twin.....	4.80
Five days over 120 days of age.....	-1.85
(-.37 lbs. per day) Adjusted Weaning Weight:	58.95 lbs.

Other than weight, culling is based on scores for face covering, type, condition, outercoat, color, horn development, belly covering, and jaw structure, whether normal or abnormal. Scoring is done by a team of three animal husbandmen, with an average of their combined scores on each animal being used for selections. Two small wool smaples are also taken from each lamb at weaning time. Samples are removed from the left side and thigh. These are then adjusted to 120 days of growth for length and cross-sectioned for fineness or fiber diameter measurement. Both length and fineness are used in making selections.

At culling, in October each year, the lambs to be saved for replacements are selected on the basis of traits measured at weaning. The mature ewes are also culled at this time on the basis of wool and lamb production, and defects such as spoiled udders, bad teeth, blindness or crippled limbs.

Ram selection is done each fall on the basis of production, body weight, and scored traits taken throughout their lifetime. Prior to breeding, all rams are sement tested. Any ram having poor quality sement is culled or not used for breeding.

In April, before shearing, the yearling and two year old ewes, and all rams are scored for all traits. At the same time a wool sample is taken from the side and thigh. Samples are then measured for staple length and cross-sectioned for fiber diameter. The method used is the "Thick-section Count Method." This also provides information as to variability, percent of medullated and kemp fibers. Samples are removed by the means of an "Oster" clipper, which allows clipping very close to the skin surface.

At shearing time all fleeces are weighed to the nearest .05 lbs. An estimate on clean wool production of each individual is obtained through the use of the Neale Squeeze Machine.

THE USE OF DOW CHEMICAL ET-57 FOR THE CONTROL OF HEADGRUBS

For a number of years the effective control of headgrubs in sheep has been expensive and difficult to administer, and in some instances dangerous unless performed by a veterinarian.

In February 1957, just after breeding, fifty head of ewes at the Southwestern Sheep Laboratory were injected with a new product designed to control headgrubs. This product was Dow Chemical ET-57 in the form of a 50% emulsifiable concentrate. The amount given was 300 miligrams per kilogram of body weight. The approximate average body weights of laboratory ewes was estimated to be 110 pounds. The proper dosage was computed to be 30 cc per ewe. This was injected directly into the rumen. The ewes injected were selected so each breeding group would be represented.

To determine the effectiveness of ET-57, the veterinarians returned to the laboratory the following November, some nine months after administering the treatment. Seven heads were obtained from the treated ewes and opened for examination. Evidence found upon examining the heads, suggested that ET-57 did produce a suitable control of headgrubs. While it had been noticed by the camp tender that several of the ewes were sick and off-feed for several days after injection, it was believed feasible to inject the entire breeding herd in December.

Prior to being put in assigned breeding pens, all laboratory ewes were injected with ET-57. A total of 798 ewes received the treatment. As daily routine checks of the breeding pens were make by the animal husbanmen, the ewes were observed for effects of the treatment. For approximatiely ten days after the injections the majority of ewes were off-feed and appeared listless. The showed little life about them, and very little interest in eating the hay being fed. Almost 100 percent suffered from diarrhea. Five or six head were checked for temperature and each found to be above normal.

There were seven death losses amonghthe breeding ewes during the breeding season. One of these was by drowning, the remaining six were from unknown causes. Most of the ewes were post-mortemed in an attempt to determine a cause. Very little was gained from this practice, as the animal husbandmen were not trained in such; however two of the posted ewes were observed to have a large black area, roughly four inches in diameter, at the site of injection. This would indicate that peritonitius could have caused death.

During lambing there were no unusual conditions that would suggest ET-57 had effected pregnancy; however there was not a control group with which comparsons could be made, so little can be said as to the effects on pregnancy.

The most decided effect of the entire operation was undoubtabley on the wool. At shearing time, in late April, the ewe fleeces had a distinct break in the center of the fiber length. The break of fiber tenderness was attributed indirectly to the effects of ET-57, since the break was caused by the poor level of nutrition after injections and the above normal temperature of the ewes.

THE USE OF DOW CHEMCIAL ET-57 FOR THE CONTROL OF HEADGRUBS CONT.

The observations made on these ewes suggest that further testing be done with ET-57, particularly on side-effects, before recommending it for commercial use.

SEMEN TESTING PROCEDURE

Each November, prior to assignment to breeding pens, all laboratory rams are semen tested. Several tests are made to determing the quality for each individual rams semen.

Samples are collected from the vagina of culled ewes saved for this purpose. Each ewe is fastened in the stanchion built in the end of a narrow chute. Rams being tested are allowed to mount the ewe until an ejaculate is obtained. The time a ram enters the chute, number of trys, and time of ejaculation is recordedd for each sample. A total of three samples per ram is considered minumum to safely determine semen quality.

After ejaculation the sample is removed by means of a glass tube and rubber sucion bulb. The sample is then transferred to a glass collection tube calibrated in 0.1 cc's. A minimum of 0.3 cc is needed for a test.

Upon collection the sample is taken to the laboratory for testing. The PH value of each sample is tested to the nearest .5. Range is usually from 6.0 to 8.0 with the sement of high quality and concentration, being more acid. Motility is estimated to the nearest z0 percent. Rams of high fertility usually have a motlity score of 3 or better (moderately active to active) and 60% motile sperm. Temperature shock or contamination (urine, soap, water, etc.) may injure motility, and if this if suspected, the ram is retested. Concentration is determined by the use of a Colorimeter. A semen sample of 0.03 cc in 6.0 cc of 4% Chlorazine solution is used. The percent transmittance gives an estimate of semen concentration.

A stained slide is also made to determing the extent of dead of abnormal sperm. A small drop or semen is mixed with a slightly larger drop of opal bule stain. This is spread with a clean slide and dried. After drying it may be examined under a high dry objective and the percent of live (unstained) sperm estimated to the nearest 10%. The abnormal sperm are then scored as follows:

1 - less than 1% abnormal sperm
2 - 1 to 15% abnormal sperm
3 - 15 to 60% abnormal sperm
4 - 60 to 85% abnormal sperm
5 - practically all abnormal sperm

Highly fertile rams should have at least 50% live sperms, not more than 1% abnormalities, and not more than 15% tail abnormalities.

RESEARCH PROJECT I

Improvement of Navajo sheep by Linebreeding and Selection within the Navajo Strain.

The Navajo Indians who live in this area of New Mexico derive a large part of their income from sheep. While the Navajo strain of sheep is becoming quite rare, a great number of the reservation sheep are a result of crossbreeding with the old type of Navajo sheep. The laboratory maintains a group of the old type Navajo sheep for a study of the effect of selection on this breed.

Of the different breeding groups maintained by the laboratory, the Navajo group is outstnading for its hardiness, milk production, and mothering ability of the ewes. This group is also well adapted to the semi- arid conditions. With improvement in wool quality and mutton conformation, the Navajo strain could provide a valuable means of tranporting these qualities to other breeds by crossbreeding.

Year	No. of Rams	Age at lambing (years)	Fleece weights as Yearlings Grease (lbs.)	Fleece weights as Yearlings Clean (lbs.)	Yearling Fiber Traits at Side Grade *	Yearling Fiber Traits at Side Staple Length (cms)	Yearling Fiber Traits at Side Medullated Fibers (percent)
1947	3	3.0	6.98	4.93	50s	17.2	1.1
1948	4	3.0	7.56	5.02	48s	18.4	.0
1949	4	4.0	7.15	4.86	48s	17.8	.0
1950	4	2.8	6.93	4.39	48s	13.9	1.8
1951	5	2.8	7.01	4.11	50s	13.1	.0
1952	5	3.4	6.04	3.50	50s	11.9	.5
1953	5	3.6	5.81	3.67	54s	11.2	.6
1954	5	2.8	5.34	3.20	54s	9.4	.6
1955	4	2.4	5.04	3.27	58s	9.2	.0
1956	3	2.2	5.37	3.59	50s	12.0	.0
1957	3	2.3	5.35	3.59	58s	12.0	0.2
1958	3	2.0	4.57	2.78	64s	8.9	.0
Average	4	2.8	6.09	3.91	52s	12.8	0.4

* Grade based on ASTM Standards.

Yearling fleece traits on Navajo breeding rams used from 1947 through 1958 are summarized in the above table. Ram selection is based largely on

quality and quanity of wool, body type, and freedom from fleece impurites, i. e., kemp, medullation, and black fibers.

The rams used in 1957 were a little finer in grade than those used in earlier years. The selection for longer staple length resulted in using rams having a slight percentage of medullation. In 1958, the rams were again selected for a finer fleece, these averaging a 64s spinning count; however the use of finer rams dcreased the average staple length, clean and grease fleece weights, but eliminated any medullation. The average age of 1958 breeding rams was two years old, which was younger than the rams used in previous years. The overall selection trend in the Navajo group has been towards a finer and more valuable fleece from a commercial standpoint, emphasizing freedom from impurities.

CHARACTERISTICS OF NAVAJO EWES

Yearling fleece and fiber traits, and age at lambing is presented in the following table for Navajo breeding ewes. The years from 1947 through 1958 are represented.

Ewes selected for breeding in the Navajo group the past two years have been slightly younger than those of the preceding years. Selection against kemp and hairy fleeces has resulted in a large decrease in the percentage of these undesirable fibers. This practice has produced a fleece grading finer and having slightly less staple length. The average grease and clean fleece weights have declined as a result, but the yield of clean wool is slightly higher per pound of grease wool than the average yield of previous years. This is probably due to the selection of more uniform fleeces that are free of impurites. The lighter body weights are partly due to the environment which has been quite dry the past few years, and partly to the trend to use younger ewes.

						Yearling Fiber Traits at Side			
			Body wt.	Fleece weights as Yearlings					
Year	No. of Ewes	Age at Lambing (years)	at 18 Months (lbs.)	Grease (lbs.)	Clean (lbs.)	Grade *	Staple Length (cms)	Kemp (percent)	Other Med. Fibers (percent)
1947	116	5.7	96.7	4.60	3.18	58s	9.5	0.9	1.7
1948	115	7.4	99.4	5.34	3.68	58s	9.0	0.6	0.6
1949	133	5.0	101.1	5.51	3.64	58s	10.0	0.3	0.8
1950	140	5.1	102.8	5.68	3.69	58s	10.2	0.2	1.2
1951	156	4.9	98.2	5.15	3.08	56s	11.1	0.0	1.5
1952	173	4.8	97.7	5.22	2.91	58s	10.2	0.1	1.6
1953	105	5.3	98.2	5.23	3.11	58s	10.4	0.1	1.7
1954	124	4.9	97.3	5.21	3.19	58s	10.5	0.1	1.1
1955	100	5.2	97.2	5.03	2.78	58s	9.9	0.0	0.6
1956	91	4.0	95.0	4.36	2.53	60s	9.6	0.0	0.4
1957	75	3.2	93.2	3.93	2.53	62s	9.6	0.0	0.02
1958	98	3.6	92.1	4.10	2.64	60s	9.4	0.0	0.02
Average	118	4.9	97.4	4.94	3.08	58s	10.0	0.2	0.9

* Grade based on ASTM Standards.

LAMB PRODUCTION OF NAVAJO MATINGS

Year	No. of Ewes Bred	Percent of Ewes Lambing	Percent of Lambs born of Ewes bred	Percent of Lambs weaned of Ewes bred	Percent of Lambs weaning of Live Lambs born	Average Weaning weight in Pounds	Pound of Lamb per Ewe Bred
1947	116	83.9	125.4	117.8	92.0	60.5	71.9
1948	115	78.9	128.5	103.3	80.4	57.3	64.4
1949	133	85.0	116.5	93.2	80.0	56.4	52.6
1950	140	61.4	78.3	68.1	87.0	42.4	28.9
1951	156	88.5	95.5	31.4	32.9	32.6	10.2
1952	173	82.1	104.0	99.4	95.5	59.5	59.1
1953	94	92.6	128.7	119.1	92.6	52.6	62.7
1954	124	83.9	102.4	100.0	97.6	52.2	51.7
1955	100	87.0	113.0	90.0	79.0	46.8	42.0
1956	91	95.6	106.5	98.9	92.0	55.5	54.9
1957	76	91.0	103.9	101.3	97.4	60.0	60.8
1958	98	95.9	125.5	106.1	85.2	49.6	52.6
1947-58	1416	85.4	110.6	94.0	84.3	52.1	50.9

Lamb production of Navajo ewes mated to Navajo rams is summarized in the above table.

The percent of ewes lambing is based on the number of ewes bred, and still present at lambing. This figure is a good indicator of fertility of both ewes and rams and takes into account any postbreeding death losses. The percent of lambs born of ewes bred is based on all lambs born, dead or alive. In 1958 over 25 percent of the Navajo ewes had twins, which was unsually high even for the Navajo group, who usually lead other groups in twinning. While the 1958 ewes produced more twins, the 1957 ewes weaned a higher percentage of lambs and heavier lambs. This is to be expected where there is a high percent of twins, those who are as a rule smaller and do not receive as much milk as singles. The desriability of twins is a questionable one. The condition of the ewes, milking ability and range as feed conditions would be the deciding factor in raising twins. It is a question of having one large lamb or two smaller lambs. The lambs weaned in 1957 led all other years since 1947 in average weaning weights. This can be attributed to better than average rainfall and feed conditions.

FACE AND BODY SCORES OF NAVAJO-WEANLING LAMBS

	RAM LAMBS				EWE LAMBS			
Year	No. of Lambs	Face Covering (score)	Type (score)	Condition (score)	No. of Lambs	Face Covering (score)	Type (score)	Condition (score)
1947	55	2.71	3.50	3.61	82	2.72	3.19	3.15
1948	71	2.83	3.10	2.88	61	2.76	3.04	2.73
1949	66	2.64	3.09	3.00	58	2.65	3.22	2.92
1950	54	2.44	3.36	4.38	40	2.33	3.23	4.02
1951	21	2.43	3.49	3.53	28	2.52	3.49	3.34
1952	90	2.10	3.68	3.74	82	2.03	3.12	3.09
1953	64	2.64	3.09	3.44	48	2.48	3.06	3.26
1954	60	2.52	3.08	3.11	64	2.59	3.12	3.34
1955	51	2.21	3.02	3.23	36	2.31	3.13	3.29
1956	46	2.22	3.08	3.12	44	2.17	3.20	3.07
1957	37	2.22	3.11	3.15	39	2.49	2.94	2.81
1958	45	2.44	3.23	3.84	59	2.43	3.31	3.84
1947-58	660	2.45	3.23	3.42	641	2.47	3.17	3.24

Face and body score, for Navajo weanling lambs are presented in the above table.

Weanling lambs are scored by a committee of Animal Husbandmen at weaning time in September. The average of the committees scored for each lamb is used in this table. Scoring may vary slightly from year to year as the committee members will not always be the same; however the scores taken in any one year can be used to compare the different groups, since all groups are scored by one committee that year. It will be ntocied that very little change has been made in face covering for the Navajo lambs from 1947-1958. The same can be said of body tyep. This is due to the typical Navajo lamb being well open-faced and characterisicly having poor body type. Also the selection emphasis has been placed on wool and freedom from defects. The condition score largely depends on the environment of each particular year and selection has little effect on this score; however condition is affected in that the better adapted animal will be in better condition. By selecting for large and hardy inviduals, the more adaptable animals will be saved, and condition scores are indirectly affected. Very littly differences can be seen between ram and ewe lambs for these scores. Lambs of both sexes have open faces, clean legs and fatten rather slowly.

FLEECE CHARACTERISTICS OF NAVAJO WEANLING LAMBS

Year	No. of Lambs Weaned	Fiber Diameter (microns)	Grade a/	Staple Length (cms)	Kemp (percent)	Other Med. Fibers (percent)	Outer--coat (score) b/
1947	137	27.8	56s	4.7	0.0	0.4	-
1948	132	28.7	54s	3.4	0.3	3.2	3.78
1949	124	29.2	54s	4.1	0.2	2.1	3.18
1950	94	28.4	56s	3.3	0.3	4.3	3.36
1951	49	25.0	60s	4.2	0.0	3.5	3.27
1952	172	29.6	54s	3.6	0.7	6.1	3.51
1953	112	31.1	50s	3.4	0.0	2.4	2.14
1954	124	25.9	58s	3.6	0.9	0.9	2.18
1955	87	26.7	58s	4.3	0.2	1.2	2.41
1956	90	27.9	56s	4.7	0.0	0.8	1.55
1957	76	28.1	56s	4.6	0.0	0.50	2.39
1958	104	27.4	56s	4.8	0.07	0.47	1.64
1947-58	1301	28.0	56s	4.0	0.2	2.16	2.67

a/ Grade for all years converted to latest ASTM Standards.
b/ Scores for outer-coat not taken prior to 1948.

Fleece characteristics of Navajo weanling lambs are summarixed for the years 1947 through 1958 in the above table.

Selection against kemp and other medullated fibers has been rigidly practiced every year and there has been noticeable progress in eliminating these undesirable traits. However, there are always a few lambs each year which have both kemp and medullation. Fiber diameter has tended to remain about the same with a slight fluctuation which is proabably due to some environmental factors. The outercoat score is considerably better for 1958 weanling lambs then the 1959 weanling lambs.

SELECTION PRACTICED ON NAVAJO WEANLING LAMBS

The selection differentials for the more important traits, the relative emphasis placed on each trait, the expected genetic gain per generation, and the percentage of lambs saved, by sex, are given in the following table. Heritability estimates for each trait are included.

The selection differentials represent the average difference between the selected lambs and the entire group from which they were selected. The selection differentials for e ach trait are computed after corrections for environmental effects are made. The relative emphasis for each trait is computed by dividing the selection differential by the standard devistion for each trait.

Heritability estimates were obtained for Navajo and Navajo Crossbred lambs for all traits except face covering, color, and outercoat scores. The heritability for face covering score used to compute the expected genetic gain was obtained on range Targhee and Columbia lambs at the U.S. Sheep Experiment Station, Dubois, Idaho. Thus the expected genetic gain for face covering is accurate only to the extent that the Dubois estimate for heritability is representative of the lambs at this station.

The expected genetic gain per generation for each sex was obtained by multiplying the selection differential times the heritability estimate. The overall expected genetic gain per generation from selection practiced at weanling ages on both sexes was computed by averaging the expected genetic gains for both rams and ewes.

All positive selection differentials indicate that the selected animals were superior to the unselected. This can be considered a genetic improvement. The negative selection differential for staple length are a result of selections against those lambs with kemp or medullated fibers, resulting in shorter staple length. This is also influenced by selecting against animals having kemp and outercoat fibers.

The greatest emphasis, at culling time, is placed on weaning weight, staple length, and condition score. As can been seen in the following table, there is a small expected gain per generation for each trait. All of these are minute, except for weaning weight. This expected genetic gain can be considered of importance.

SELECTION PRACTICED ON NAVAJO WEANLING LAMBS

Year	Sex		Weaning Weight (lbs.)	Staple Length (cms)	Fiber Diameter (microns)	Face Covering (score)	Body Type (score)	Condition (score)	Color (score)	Outer-coat (score)	Percent Saved
1957		Heritability	21%	6%	30%	46% *	4%	11%	-	-	
	Rams	Selection Differentials	3.71	.44	.20	-.07	-.28	-.23	.16	-.03	34%
		Relative Emphasis	.46	.37	.11	-.14	-.58	-.46	.20	-.04	
		Expected Genetic Gain	.78	.026	.06	-.032	-.011	-.025	-	-	
	Ewes	Selection Differentials	.19	-.47	-.30	-.05	-.21	-.16	-.18	-.45	77%
		Relative Emphasis	.04	-.31	-.19	-.13	-.53	-.36	-.18	-.43	
		Expected Genetic Gain	.039	-.028	-.09	-.023	-.008	-.018	-	-	
	Rams and Ewes	Expected Genetic Gain per Gneration	.41	-.001	-.015	-.028	-.009	-.022	-	-	
1958											
	Rams	Selection Differentials	3.72	.03		-.04	-.17	-.22	-.143	-.093	47%
		Relative Emphasis	.48	.029		-.128	-.50	-.47	-.16	-.19	
		Expected Genetic Gain	.78	.0018		-.020	-.007	-.02	-	-	
	Ewes	Selection Differentials	1.71	-.53		-.16	-.17	-.13	-.12	-.107	58%
		Relative Emphasis	.30	-.514		-.418	-.487	-.33	-.13	-.24	
		Expected Genetic Gain	.359	-.032		-.073	-.007	-.015	-	-	
	Rams and Ewes	Expected Genetic Gain per Generation	.57	-.015		-.047	-.007	-.018	-	-	

* Heritability estimate for Face Covering score as obtained for range Targhee and Columbia lambs at Dubois, Idaho.

BODY WEIGHTS AND SCORES OF NAVAJO YEARLING RAMS

Year	No. of Rams	Body Weight (lbs.)	Face Covering (score)	Type (score)	Condition (score)	Color (score)	Outer-coat * (score)
1947	2	115.0	2.25	3.17	3.09	1.50	-
1948	6	115.2	2.23	3.20	2.96	1.17	-
1949	14	112.3	2.33	2.89	2.64	1.36	2.24
1950	10	103.5	2.60	3.00	2.97	1.50	2.07
1951	9	90.9	2.58	2.67	3.13	1.00	3.60
1952	2	101.0	1.94	3.66	3.44	1.00	2.00
1953	8	112.0	1.27	2.90	2.68	1.50	2.63
1954	10	95.8	1.60	3.65	2.88	1.10	1.48
1955	11	111.0	1.68	2.74	3.15	1.09	1.85
1956	10	95.0	1.60	3.23	3.28	1.10	1.90
1957	11	94.5	1.89	3.12	3.55	1.00	1.88
1958	13	112.9	1.88	3.66	3.60	1.38	1.65
1947-58	106	104.9	1.98	3.10	3.12	1.13	2.13

* Scores for outer-coat not taken prior to 1949.

Body weights and scores in the above table were taken in June, when the rams were approximately 13 months old. The 1958 yearling Navajo rams were considerably above average in body weight, while the 1957 rams were below average. The rest of the traits were in line with the twelve year average, with the exception of outer-coat score, which is better than the average.

FLEECE CHARACTERISTICS OF NAVAJO YEARLING RAMS

Year	No. of Rams	Fleece Weights Grease (lbs.)	Clean (lbs.)	Fiber Diameter (microns)	Grade *	Staple Length (cms)	Medullated Fibers (percent)
1947	2	7.18	4.70	33.6	46s	14.8	0.0
1948	6	6.65	3.88	32.0	48s	15.0	1.2
1949	14	6.43	4.30	28.8	54s	11.6	0.1
1950	10	6.56	3.92	28.1	56s	12.6	.0
1951	9	5.82	3.32	30.0	54s	12.8	2.1
1952	2	5.39	3.07	29.1	54s	9.5	.0
1953	8	5.09	3.20	30.3	50s	10.4	.0
1954	10	3.95	2.72	23.6	62s	7.8	.0
1955	11	5.14	3.32	27.4	56s	10.0	0.1
1956	10	5.07	3.02	23.4	50s	10.3	.0
1957	11	4.55	2.85	23.8	62s	9.3	.0
1958	13	4.86	2.98	25.5	58s	10.5	1.1
1947-58	106	5.55	3.44	27.9	56s	11.2	0.4

* Grade based on ASTM Standards.

Fleece characteristics of Navajo yearling rams are summarized in the above table. Through selection, the average fleece grade has become progressively finer. This has resulted in a slight decrease in staple length, and with the exception of 1958, the percent of medullated fibers has decreased.

BODY WEIGHTS AND SCORES OF NAVAJO YEARLING EWES

Year	No. of Ewes	Body Weight (lbs.)	Face Covering (score)	Type (score)	Condition (score)	Color (score)	Outer-coat * (score)
1947	39	84.6	2.07	3.13	3.13	2.46	-
1948	75	86.8	2.58	2.97	2.68	1.32	-
1949	55	77.9	2.31	2.74	2.49	1.72	3.08
1950	46	75.7	2.43	2.84	2.91	1.30	3.05
1951	26	46.6	2.51	3.35	3.20	1.88	3.38
1952	11	75.4	1.92	3.06	3.22	2.39	3.91
1953	40	67.6	1.65	3.08	3.13	1.58	3.61
1954	27	73.1	1.93	3.24	2.91	1.26	2.50
1955	30	73.2	1.75	3.10	3.19	1.60	2.31
1956	21	68.8	1.77	3.10	3.29	1.76	2.60
1957	26	85.3	2.10	3.11	3.33	1.46	1.87
1958	30	80.5	2.07	3.67	3.81	1.54	1.62
1947-58	426	74.6	2.09	3.12	3.10	1.68	2.79

* Score for outer-coat not taken prior to 1949.

The 1957 and 1958 yearling Navajo ewe body weights are above the twelve year average. The 1957 body weights are the second highest on record. Face covering scores were rather poor, and show a loss for the trait scored during those two years. Type and conditions are about average, while gains have been made in color and outer-coat.

FLEECE CHARACTERISTICS OF NAVAJO YEARLING EWES

Year	No. of Ewes	Fleece Weights Grease (lbs.)	Fleece Weights Clean (lbs.)	Fiber Diameter (microns)	Grade *	Fiber Traits at Side: Staple Length (cms)	Fiber Traits at Side: Kemp (percent)	Other Medullated Fibers (percent)
1947	39	5.14	4.00	31.6	50s	11.4	0.1	3.0
1948	75	6.19	3.82	28.1	56s	12.5	.2	1.1
1949	55	5.73	3.69	26.0	58s	10.5	.5	3.0
1950	46	6.38	3.38	26.1	58s	11.4	.1	1.6
1951	26	3.27	1.75	21.4	64s	10.2	.1	.9
1952	11	5.14	2.77	28.9	54s	9.1	.0	.7
1953	40	4.57	2.99	26.2	58s	10.6	.3	.8
1954	27	4.31	2.91	24.8	60s	8.8	.0	.1
1955	30	3.80	2.33	22.4	64s	10.0	.0	.0
1956	21	3.85	2.32	23.1	64s	9.6	.0	.0
1957	26	4.27	2.76	26.3	58s	9.2	.0	.0
1958	30	4.32	2.78	26.3	58s	8.7	.0	.4
1947-58	426	4.74	2.95	25.9	58s	10.1	.1	.9

* Grade based on ASTM Standards.

Yearling Navajo ewes have shown a gain towards the elimination of kemp, hair, and medullated fibers. This has resulted in a finer fleece, having slightly shorter staple length and less weight; however the increase in fleece value due to freedom from impurities will off set the weight loss.

RESEARCH PROJECT II

Improvement of Finewool sheep under Southwestern conditions.

There are three distinct lines of breeding, included in this research project. Breeding group 13 was developed from mating Targhee rams to ewes with fine wool selected from the crossbred groups. Breeding groups 20, 21, and 22 are composed of average reservation ewes mated to average reservation rams, ram pasture rams and Targhee rams, respectively. Group 25 is composed of a pure line of Targhee sheep.

The objective of this project is the development of a finewool sheep suited to this Southwestern area. Emphasis is placed on staple length, grade, freedom from kemp and medullation, adaptability, and lamb production. As a result of selecting for the above traits, it is hoped to develop an animal that will produce a maximum of wool, of a suitable quality, and produce lambs that will meet the requirements for feed lot operations. The combination of these should provide a maximum return on sheep investments.

CHARACTERISTICS OF FINEWOOL BREEDING RAMS

Year and Breeding Group No.	No. of Rams	Age at Lambing (years)	Body Wt. at Breeding (lbs.)	Yearling Fleece Weights Grease (lbs.)	Yearling Fleece Weights Clean (lbs.)	Yearling Fiber Traits side Grade *	Yearling Fiber Traits side Staple Length (cms)
1957							
Group							
13	3	2.00	147.6	8.66	5.36	62s	10.33
20	10	2.00	136.0	5.84	2.74	80s	5.64
21	10	-	-	-	-	-	-
22	10	2.5	158.6	10.1	5.89	70s	8.20
25	6	2.7	178.8	12.6	5.72	62s	9.52
Total & Averages	49	2.3	155.3	9.30	4.93	70s	8.42
1958							
Group							
13	3	2.3	163.3	6.73	3.83	70s	9.00
20	10	2.0	125.5	4.79	2.20	80s	5.05
21	10	-	-	-	-	-	-
22	10	3.0	174.3	10.33	4.52	62s	8.16
25	6	2.6	181.4	11.28	5.44	64s	9.18
Total & Averages	49	2.5	161.1	8.28	4.00	70s	7.85

* Grade based on ASTM Standards.

** Rams used in Group 21 for 1957-58 were obtained from private breeder, and yearling records were not available.

CHARACTERISTICS OF FINEWOOL BREEDING EWES

In the following table is presented the characteristics of the finewool breeding ewes that were in the breeding flock during 1957 and 1958. Data is presented as to number of ewes, age at lambing, body weight at 18 months of age, and yearling measurements for grease and cleen fleece weights, grade, staple length, and percent medullation.

Measurements for most of the traits are near the ten year average; however it can be seen that substantial progress has been made in the elimination of medullated fibers. There was no medullation present in 1957 and 1958. The decrease in medullation has resulted in a finer average grade, but has resulted in a decrease in staple length. It is also reflected in the grease and clean fleece weights which are below the 10 year average. Yearling records were not available for most of the Targhee ewes (group 25) since these ewes were obtained from private breeders.

Year and Breeding Group No.	No. of Ewes	Age at Lambing (years)	18 mos. Body Wt. (lbs.)	Grease (lbs.)	Clean (lbs.)	Grade *	Staple Length (cms)	Med. Fibers (percent)
1957								
Group								
13	76	3.57	102.7	5.78	2.92	70s	8.13	0.0
20	77	3.69	100.0	4.70	1.93	80s	5.13	0.0
21	76	3.80	96.1	4.87	2.09	70s	5.48	0.0
22	77	3.66	99.8	4.96	2.06	70s	5.59	0.0
25**	67	4.61	113.7	-	-	-	-	-
Total & Averages	373	3.87	102.5	5.08	2.25	70s	6.08	0.0
1958								
Group								
13	107	2.75	102.9	5.97	2.99	70s	8.22	0.0
20	111	3.32	98.2	5.34	2.31	70s	5.38	0.0
21	97	3.85	96.9	5.35	2.36	80s	6.04	0.0
22	96	3.86	101.5	5.48	2.42	70s	6.02	0.0
25**	72	3.75	107.3	-	-	-	-	-
Total & Averages	483	3.51	101.4	5.54	2.52	70s	6.42	0.0
1949-58	2857	3.96	100.8	5.81	2.72	64s	7.51	.44

* Grade based on ASTM Standards.

** Records not available on some traits. Most of these ewes were purchased from private breeders.

LAMB PRODUCTION OF FINEWOOL MATING

The following table summarizes the lamb production of the finewool group. The average for 1949-58 is presented at the bottom of the table. As in prior tables the percent of ewes lambing is based on the number present at time of lambing. Percent of lambs born is based on actual births, whether dead or alive. Percent of lambs weaned shows the death loss between lambing and weaning. The average weaning weights is indication of the milk production of the ewe and range conditions.

The 1957 production is above the average in all but one instance. The percent of lambs weaned of live lambs born, average weaning weight, and pounds of lamb per ewe is exceptionally good. The 1958 production is below the ten year average in all respects except the percent of lambs born of ewe lambing which indicates a high percent of twinning; however a low percent of these lambs were weaned.

Year and Breeding Group No.	No. of Ewes Bred	Percent of Ewes Lambing	Percent of Lambs Born of Ewes Lambing	Percent Lambs Weaned of live Lambs Born	Percent Lambs Weaned of Ewes Bred	Average Weaning Wt. in Pounds	Pounds of Lamb per Ewe Bred
1957							
Group							
13	76	96.1	113.9	95.1	101.3	64.7	65.6
20	77	93.5	105.6	88.1	87.0	61.2	53.2
21	77	95.8	102.8	89.2	86.8	62.2	54.0
22	75	97.3	104.1	93.2	88.3	62.8	56.3
25	67	76.2	108.3	88.5	68.7	65.6	44.1
Total & Averages	373	91.6	106.9	90.8	86.4	63.3	54.64
1958							
Group							
13	107	92.3	121.9	69.1	71.0	53.2	37.8
20	111	93.4	128.3	76.0	85.6	53.0	45.4
21	97	90.4	117.6	74.2	74.2	49.1	36.4
22	96	85.7	130.8	74.5	79.2	56.7	44.8
25	72	85.9	129.1	66.7	58.3	55.1	32.1
Total & Averages	483	89.5	125.5	72.1	73.7	53.4	39.3
1949-58	2857	89.2	118.5	80.3	80.1	57.9	46.6

FACE AND BODY SCORES OF FINEWOOL WEANLING LAMBS

Weaning scores for face covering, type, and condition are presented in the following table. These scores are taken at weaning time when the lambs are approximately four months of age. The scores for the ram lambs for type and condition were better than the ewe lambs for 1957. The scores for the ewe lambs of 1957 and 1958 and the rams lambs of 1958 are about the same as the ten year average. The ewe lambs scored better than the ram lambs for the 1949-58 average.

	RAM LAMBS				EWE LAMBS			
Year and Breeding Group No.	No. of Lambs	Face Covering (score)	Type (score)	Condition (score)	No. of Lambs	Face Covering (score)	Type (score)	Condition (score)
1957								
Group								
13	42	2.95	2.27	2.57	35	2.89	2.36	2.37
20	40	3.39	2.77	2.56	27	3.66	2.89	2.55
21	36	3.42	2.60	2.57	31	3.10	2.72	2.55
22	37	3.08	2.34	2.35	33	3.07	2.90	2.69
25	20	3.05	2.16	2.22	24	3.07	3.00	2.87
Total & Averages	175	3.18	2.31	2.45	150	3.16	2.77	2.61
1958								
Group								
13	28	2.93	2.87	3.45	46	2.90	3.32	3.86
20	51	3.44	3.30	3.78	42	3.34	3.34	3.86
21	31	3.31	3.43	3.97	41	3.32	3.32	3.78
22	32	3.08	3.16	3.65	43	3.20	3.20	3.73
25	18	3.13	3.08	3.49	21	2.68	2.68	3.25
Total & Averages	160	3.18	3.17	3.67	193	3.15	3.15	3.70
1949-58	1025	2.85	2.93		1074	2.94	2.75	2.86

FLEECE CHARACTERISTICS OF FINEWOOL WEANLING LAMBS

Year and Breeding Group No.	No. of Lambs	Fiber Diameter (microns)	Grade *	Staple Length (cms)	Kemp (percent)	Other Med. Fibers (percent)	Outer-coat (score)
1957							
Group							
13	77	24.94	60s	3.81	0.03	0.83	1.29
20	68	21.18	64s	2.22	0.02	0.19	1.21
21	64	20.6	70s	2.84	-	0.24	1.08
22	70	23.3	62s	2.72	0.02	.23	1.14
25	45	22.76	62s	3.07	-	0.22	1.10
Total & Averages	324	22.56	62s	2.93	0.34	0.34	1.16
1958							
Group							
13	76	24.1	60s	4.62	0.06	1.09	1.20
20	94	22.6	62s	2.40	0.05	.11	1.17
21	72	20.8	70s	3.12	0.003	.03	1.02
22	76	23.7	62s	3.23	0.04	.06	1.07
25	41	22.3	64s	3.52	0.01	-	1.02
Total & Averages	359	22.7	62s	3.38	0.01	0.26	1.10
1957-58	683	22.67	62s	3.16	0.01	0.30	1.13
1949-56 Averages	1420	24.25	60s	3.00	0.08	0.62	1.37

* Grade based on ASTM Standards.

The above table summarizes the fleece characteristics of the finewool weanling lambs. There is a slight difference among the groups with regard to mean fiber diameter, percent of kemp and medullation, and outer-coat scores. Group 20 showed a shorter staple length both 1957-58 than the other groups. The average for all traits for the 1949-56 period shows that the 1957-58 lambs were producing a finer grade of wool, slightly longer staple, and with a lower percentage of kemp and medullated fibers. The score for outer-coat is also better than the eight year average.

SELECTION PRACTICED ON FINEWOOL WEANLING LAMBS

The selection practiced on the finewool weanling lambs in 1957 and 1958 are summarized in the following table. The selection differentials, relative emphasis, and the expected genetic gain are presented for rams and ewes by breeding groups. A positive selection differential for weaning weight and staple length is desirable and indicates a selection of animals that are above the average for those traits. With regard to fiber diameter, a negative selection differential indicates the selection of animals with finer fleeces. This is desirable for the finewool groups. All other traits, which are meausred by the scoring method, should have negative selection differentials when the better animals are selected ; however the necessity of selecting highly outstanding animals in traits such as body weight and staple length, results in the selection of some animals with perhaps lower face and body scores. This situation is reflected when a positve selection differential is present for traits which are measured by the scoring method. The heritability estimate for face covering was obtained on range Targhee and Columbia lambs at the U.S. Sheep Experiment Staion at Dubois, Idaho. As a result, the calculated expected genetic gainaare accurate only to the extent that the heritability estimate from Dubois is applicable to the lambs to this station.

No rams were saved in groups 21 and 22 since the ewes saved from these groups are bred to rams obtained from outside sources. In 1957, a slightly higher percent of ewes from each group were saved in an attempt to increase the number within each breeding group to the desired level. In 1958, the percent of animals saved was reduced due to the increase in the number of individual from which selection was made.

SELECTION PRACTICE ON FINEWOOL WEANLING LAMBS

Year and Group No.	Sex		Weaning Weight (lbs.)	Staple Length (cms)	Fiber Diameter (microns)	Face Covering (score)	Body Type (score)	Condition (score)	Color (score)	Outer coat (score)	Percent Saved
1957		Heritability	21%	6%	30%	46% *	4%	11%	-	-	
Group 13	Rams	Selection Differential	3.83	-.03	-.22	-.14	-.22	-.06	-.07	-.19	52%
		Relative Emphasis	.498	-.033	-.133	-.35	-.48	-.14	-.157	-.347	
		Expected Genetic Gain	.80	-.002	-.066	-.06	-.009	-.007	-	-	
	Ewes	Selection Differential	- .70	-.01	.14	-.08	-.06	-.08	.01	-.05	83%
		Relative Emphasis	- .075	-.15	.086	-.20	-.138	-.12	.057	-.167	
		Expected Genetic Gain	- .147	-.0006	.042	-.037	-.002	-.009	-	-	
	Rams and Ewes	Expected Genetic Gain per Generation	.33	-.0013	.014	-.049	-.0006	-.008	-	-	
Group 20	Rams	Selection Differential	- .46	-.15	-.47	-.05	.06	0	.15	-.05	38%
		Relative Emphasis	- .058	-.320	-.267	-.224	.150	0	.152	-.109	
		Expected Genetic Gain	- .097	-.009	-.141	-.023	.002	0	-	-	
	Ewes	----------	All Ewes Saved in Group 20								100%
Group 21	Rams	----------	No Rams Saved in Group 21								
	Ewes	Selection Differential	2.42	-.41	.28	.04	-.17	-.25	-.04	.10	87%
		Relative Emphasis	.314	-.261	.162	.025	-.34	-.510	-.179	.148	
		Expected Genetic Gain	.508	-.025	.084	.018	-.007	-.028	-.	-	

SELECTION PRACTICED ON FINEWOOL WEANLING LAMBS

Year and Group No.	Sex		Weaning Weight (lbs.)	Staple Length (cms)	Fiber Diameter (microns)	Face Covering (score)	Body Type (score)	Condition (score)	Color (score)	Outer-coat (score)	Percent Saved
1957											
Group 22	Rams	----------			No Rams Saved in Group 22						
	Ewes	Selection Differential	7.15	-.15	.27	-.14	-.52	-.46	-	-.13	82%
		Relative Emphasis	.496	-.135	.149	-.265	-.812	-.80	-	-.361	
		Expected Genetic Gain	1.50	.009	.081	-.064	-.021	-.031	-	-	
1957											
Group 25	Rams	Selection Differential	5.50	.08	-.26	-.07	-.28	-.21	-.26	-	70%
		Relative Emphasis	.27	.09	-.122	-.089	-.35	-.429	-.313	-	
		Expected Genetic Gain	1.16	.005	-.060	-.032	-.011	-.023	-	-	
	Ewes	Selection Differential	5.10	.19	-.13	-.10	-.66	-.65	.08	-	92%
		Relative Emphasis	.552	.331	-.122	-.171	-.867	-.929	.194	-	
		Expected Genetic Gain	1.07	.011	-.039	-.046	-.026	-.072	-	-	
	Rams and Ewes	Expected Genetic Gain per Generation	1.12	.008	-.011	-.039	-.019	-.047	-	-	

SELECTION PRACTICED ON FINEWOOL WEANLING LAMBS

Year and Group No.	Sex		Weaning Weight (lbs.)	Staple Length (cms)	Fiber Diameter (microns)	Face Covering (score)	Body Type (score)	Condition (score)	Color (score)	Outer-coat (score)	Percent Saved
1958											
Group 13	Rams	Selection Differential	3.94	-.37		.02	-.163	-.14	.06	-.26	39%
		Relative Emphasis	.46	-.55		.045	-.419	-.297	.069	-.981	
		Expected Genetic Gain	.83	-.022		.009	-.007	-.015	-	-	
	Ewes	Selection Differential	4.58	-.20		-.037	-.32	-.34	-.02	-.078	67%
		Relative Emphasis	.59	-.25		-.038	-.94	-.12	-.064	-328	
		Expected Genetic Gain	.96	-.012		-.002	-.013	-.037	-	-	
	Rams and Ewes	Expected Genetic Gain per Generation	.90	-.017		-.006	-.01	-.026			
1958											
Group 20	Rams	Selection Differential	- .37	-.19		.01	.12	.17	.13	-.10	29%
		Relative Emphasis	- .117	-.337		.044	.248	.267	.129	-.322	
		Expected Genetic Gain	- .078	-.011		.005	.048	.019	-	-	
	Ewes	----------		All Ewes Saved in Group 20							100%
Group 21	Rams	----------		No Rams Saved in Group 21							
	Ewes	Selection Differential	2.15	-.308		-.185	-.13	-.174	-.20	-	73%
		Relative Emphasis	.216	-.073		-.343	-.307	-.310	-.277	-	
		Expected Genetic Gain	.452	-.002		-.085	-.005	-.019	-	-	

SELECTION PRACTICED ON FINEWOOL WEANLING LAMBS

Year and Group No.	Sex		Weaning Weight (lbs.)	Staple Length (cms)	Fiber Diameter (microns)	Face Covering (score)	Body Type (score)	Condition (score)	Color (score)	Outer-coat (score)	Percent Saved
1958											
Group 22	Rams	----------		No Rams Saved in Group 22							
	Ewes	Selection Differential	3.55	.16		-.02	-.49	-.43	.13	-.04	73%
		Relative Emphasis	.96	.238		-.051	-.723	-.729	.145	-.231	
		Expected Genetic Gain	.75	.010		-.009	-.046	-.047	-	-	
Group 25	Rams	Selection Differential	5.37	.12		.012	-.40	-.24	-	.005	
		Relative Emphasis	.418	.266		.027	-.433	-.433	-	.125	
		Expected Genetic Gain	1.13	.007		.006	-.026	-.026	-	-	
	Ewes	----------		All Ewes Saved in Group 25							100%

* Heritability estimate for Face Covering score as obtained for range Targhee and Columbia Lambs at Dubois, Idaho.

BODY WEIGHTS AND SCORES OF FINEWOOL YEARLING RAMS

Year and Breeding Group No.	No. of Rams	Body Weights (lbs.)	Type (score)	Face Covering (score)	Condition (score)	Color (score)	Outer-coat (score)
1957							
Group							
13	17	93.5	2.59	2.34	2.89	1.00	1.00
20	15	84.0	3.46	2.86	3.42	1.13	1.07
21			No Rams	Saved			
22			No Rams	Saved			
25	14	95.6	2.61	3.27	2.80	1.00	1.00
Total & Averages	46	91.0	2.89	2.82	3.04	1.04	1.02
1958							
Group							
13	21	118.1	2.98	2.23	3.06	1.05	
20	15	105.6	3.85	3.04	3.73	1.40	
21			No Rams	Saved			
22			No Rams	Saved			
25	14	123.1	2.95	2.61	2.85	1.14	1.00
Total & Averages	50	115.6	3.26	2.63	3.21	1.20	1.01
1957-58 Averages	96	103.3	3.08	2.73	3.13	1.12	1.02
1950-56 Averages	180	109.1	2.42	2.66	2.24	1.09	1.12

The 1958 finewool yearling rams were above the 1957 rams in body weight, face covering, and outer-coat. In comparing the scores of 1957-58 with those of 1950-56 it is clearly seen that all the traits were below the 1950-56 average except outer-coat score. The 1957 rams were several pounds below average with respect to body weight but they were only slighly below average with respect to type, condition, and face covering. The 1958 rams were several pounds above the average for body weight but were below the average for all the other traits except face covering and outer-coat scores.

FLEECE CHARACTERISTICS OF FINEWOOL YEARLING RAMS

Year and Breeding Group No.	No. of Rams	Fleece Weights Grease (lbs.)	Fleece Weights Clean (lbs.)	Fiber Diameter (microns)	Fiber Traits at Side Grade *	Fiber Traits at Side Staple Length (cms)
1957						
Group						
13	17	5.78	2.86	19.12	80s	8.28
20	15	5.01	2.30	18.79	80s	5.01
21		No Rams Saved				
22		No Rams Saved				
25	14	6.78	3.16	21.15	64s	7.71
Total & Averages	46	5.86	2.77	19.69	70s	7.00
1958						
Group						
13	21	7.34	3.85	23.25	60s	8.92
20	15	5.31	2.73	19.54	80s	5.02
21		No Rams Saved				
22		No Rams Saved				
25	14	7.01	3.48	19.71	70s	7.39
Total & Averages	50	6.55	3.35	20.83	70s	7.11
1957-58 Averages	96	6.21	3.06	20.26	70s	7.06
1950-56 Averages	180	7.49	3.94	22.48	64s	8.53

* Grade based on ASTM Standards.

The above table summarizes the fleece characteristics of finewool yearling rams. As noted in the preceding section, there were no rams saved from the breeding groups 21 and 22. Rams for these were obtained from outside sources.

Rams in the 1957 breeding groups have a similar grade when compared to the 1958 breeding groups; however the staple length is slightly longer for the 1958 breeding groups. This is also evident with respect to the average grease and clean fleece weights for the 1958 breeding group. It is also evident that the grease and clean fleece weights, and staple length is below the 1950-56 average. This is what one would expect since the grade is finer for the 1957- and 1958 breeding group. While it is not shown in the table, the shrinkage and yield of the 1957-58 finewool groups vary some four percent, with the 1958 breeding groups having the highest shrinkage and heavier yield.

BODY WEIGHTS AND SCORES OF FINEWOOL YEARLING EWES

Year and Breeding Group No.	No. of Ewes	Body Weights (lbs.)	Type (score)	Condition (score)	Face Covering (score)	Color (score)	Outer-coat (score)
1957							
Group							
13	35	88.03	2.25	2.24	2.07	1.06	1.00
20	50	86.00	2.82	2.52	2.65	1.77	1.08
21	31	83.00	2.66	2.41	3.22	1.03	1.00
22	28	92.00	2.45	2.20	2.59	1.00	1.11
25	20	92.89	2.19	2.07	2.58	1.00	1.03
Total & Averages	166	88.38	2.47	2.29	2.62	1.17	1.04
1958							
Group							
13	24	88.71	3.08	3.35	2.22	1.04	1.00
20	26	79.3	3.51	3.53	2.90	1.15	1.03
21	27	86.2	3.23	3.36	3.17	1.03	1.00
22	26	86.4	3.21	3.33	2.40	1.04	1.00
25	17	90.6	2.95	3.10	2.40	1.06	1.00
Total & Averages	120	86.24	3.20	3.33	2.62	1.06	1.01
1957-58 Averages	286	87.31	2.70	2.81	2.62	1.12	1.03
1950-56 Averages	425	74.75	2.48	2.41	2.23	1.20	1.24

The above table summarizes the body weights and scores of finewool yearling ewes for 1957 and 1958. On the average, the 1957 yearling ewes were superior or equal to the 1958 yearling ewes. The average body weight for the finewool yearling ewes in 1957 was two pounds heavier than those of 1958. In comparing general range conditions and moisture received, 1957 was a better year than 1958. The lack of progress in 1958 relative to type and condition can be attributed to the above fact. However, the 1957 and 1958 average for body weight is over twelve pounds heavier than the 1950-56 average; but the 1950-56 average for all the scoring traits are considerable better than the 1957-58 can be attributed to the face that the breeding groups of the finewool sheep were below the desired level with regard to numbers so in order to increase the number of breeding individuals a larger percentage of the yearling ewes had to be saved for replacement. This procedure led to the inclusion of some animals that would not have otherwise been kept if the breeding flock had been at the desired size.

FLEECE CHARACTERISTICS OF FINEWOOL YEARLING EWES

Year and Breeding Group No.	No. of Ewes	Fleece Weights Grease (lbs.)	Fleece Weights Clean (lbs.)	Fiber Diameter (microns)	Fiber Traits at Side Grade *	Fiber Traits at Side Staple Length (cms)
1957						
Group						
13	35	6.45	3.03	21.46	64s	8.37
20	50	6.24	2.73	21.07	70s	5.72
21	31	6.77	2.93	19.14	80s	6.77
22	28	6.85	3.05	20.11	70s	7.01
25	20	6.35	2.87	19.30	80s	7.62
Total & Averages	166	6.53	2.92	20.22	70s	7.10
1958						
Group						
13	24	6.46	3.44	24.61	60s	7.99
20	26	4.82	2.47	20.07	70s	4.85
21	27	6.47	2.95	19.75	70s	6.35
22	26	5.81	3.12	21.78	64s	6.31
25	17	5.82	3.00	19.21	80s	6.59
Total & Averages	120	5.88	3.00	21.09	70s	6.42
1957-58 Averages	286	6.21	2.96	20.66	70s	6.76
1950-56 Averages	425	5.81	2.72	19.63	70s	7.50

* Grade based on ASTM Standards.

The fleece characteristics of the finewool yearling ewes for 1957 and 1958 indicate that some progress has been made with regard to the clean wool yield. This pheunomena is evident even though the finewool yearling ewes in 1957 produced heavier fleece weights. While it is not shown in the table, the shrinkage and yield of the 1957-58 finewool groups vary some six percent even though the grade is basically the same, both groups being of 70s spinning count. However, the fleeces were unusually clean and light shrinking for 1958. This same fact was true over much of New Mexico with regard to most commerical sheep enterprizes. The 1957 finewool yearling ewes showed a greater staple length than the 1958 finewool yearling ewes. The 1950-56 average is lower in grease weight but approximately the same with regard to clean wool yield for 1957-58. The 1950-56 ewe average show a greater staple length but the same spinning count.

RESEARCH PROJECT III

Improvement of coarsewool sheep for the production of wool suitable for Navajo handweaving.

The objectives of this project is the development of a coarsewool sheep than will produce wool suitable for the needs of the Navajo Inkian, and lambs of suitable quality for feeding. Apportion of the wool grown by the Navajo is used in hand weaving rugs and blankets. This wool should be in a grade range of 46 to 58s spinning count. The production of the above quality wool on an animal adaptable to this environment is of utmost importance to the welfare of the Navajo Indian; therefore selection has been placed primarily on those animals displaying hardiness, adaptability, body size, good staple length and clean wool production.

CHARACTERISTICS OF COARSEWOOL BREEDING RAMS

Year and Breeding Group No.	No. of Rams	Age at Lambing (years)	Body Weight at Breeding (lbs.)	Yearling Fleece Weight Grease (lbs.)	Yearling Fleece Weight Clean (lbs.)	Yearling Fiber Traits Grade *	Yearling Fiber Traits Staple Length (cms)	Yearling Fiber Traits Med. Fibers (percent)
1957								
Group								
16	3	2.0	154.6	7.55	5.25	60s	13.6	0
23	10	2.8	150.8	6.69	4.53	58s	12.0	0
Total & Averages	13	2.4	152.7	7.12	4.89	58s	12.8	0
1958								
Group								
16	3	2.0	138.7	5.70	3.61	56s	8.70	0
23	10	2.3	14317	5.96	3.70	62s	10.97	0
Total & Averages	13	2.3	141.2	5.83	3.66	60s	9.80	0
1957-58 Averages	26	2.3	147.0	6.48	4.28	60s	11.3	0
1950-56 Averages	294	3.4	168.7	8.56	5.03	50s	12.2	.03

The above table present data concerning the characteristics of coarsewool rams used for 1957 and 1958 lamb crops. It should be noticed that the rams of these two groups are large and shear a large, light-shrinking fleece. The 1958 breeding rams are below the 1957 rams in body weight, grease fleece weight, clean weight, clean fleece weight, and staple length.

CHARACTERISTICS OF COARSEWOOL BREEDING RAMS CONT.

The decreased body weight of the breeding rams of 1958 can partly be attributed to the difference in age of the rams. While it is not shown in the table, the shrinkage and yield of the 1957-58 coarsewool groups vary some six percent with the coarser, longer 1957 groups being the lightest shrinking and heavier yielding. Rams used in 1957-58 were finer, younger, lighter, more actual clean wool, shorter staple length, and freer from medullated fibers than rams used from 1950 through 1596. The 1957-1958 breeding rams were the lighter in shrinkage and heavier in yielding than the rams used from 1950 through 1956.

CHARACTERISTICS OF COARSEWOOL BREEDING EWES

Year and Breeding Group No.	No. of Ewes	Age at Lambing (years)	18 mos. Body Weight (lbs.)	Yearling Fleece Weights Grease (lbs.)	Yearling Fleece Weights Clean (lbs.)	Yearling Fiber Traits Grade *	Yearling Fiber Traits Staple Length (cms)	Yearling Fiber Traits Med. Fibers (percent)
1957								
Group								
16	75	3.20	103.4	5.15	3.28	62s	10.84	0.23
23	77	3.60	98.9	4.75	2.18	70s	6.20	0.02
Total & Averages	152	3.40	101.2	4.95	2.73	64s	8.52	0.13
1958								
Group								
16	112	3.4	104.7	5.52	3.30	60s	10.67	0.02
23	104	3.79	99.2	5.04	2.46	64s	6.77	0.02
Total & Averages	216	3.60	101.9	5.28	2.88	62s	8.72	0.02
1957-58 Averages	368	3.50	101.6	5.12	2.81	64s	8.62	0.08
1950-56 Averages	2778	4.14	102.7	6.50	3.60	60s	10.2	0.55

* Grade based on ASTM Standards.

Number of ewes per group, age at lambing, body weight, and yearling fleece characteristics are presented in the above table for coarsewool breeding ewes.

Ewes in these breeding groups are larger bodied and longer stapled than those of the other previously reported groups. Body weight has remained fairly constant, but staple length and clean wool yield have decreased somewhat. This decrease is probably due to greater selection being put on finer fleeced ewes, having a greaser fleece.

LAMB PRODUCTION OF COARSEWOOL MATINGS

Year and Breeding Group No.	No. of Ewes Bred	Percent of Ewes Lambing	Percent Lambs Born of Ewes Lambing	Percent Lambs Weaned of Live Lambs Born	Percent Lambs weaned of Ewes Bred	Average Weaning Wt. in Pounds	Pounds of Lamb per Ewe Bred
1957							
Group							
16	75	90.7	108.8	100.0	97.3	63.0	62.1
23	77	97.4	104.0	96.1	94.8	64.9	57.3
Total & Averages	152	94.1	106.4	98.1	96.1	64.0	59.7
1958							
Group							
16	111	92.8	107.2	62.9	65.8	54.4	38.2
23	104	88.5	125.0	77.5	82.7	56.7	46.9
Total & Averages	215	90.7	116.1	70.2	74.3	55.6	42.6
1957-58 Averages	367	92.4	111.3	84.1	85.2	59.8	51.2
1937-58 Averages	8435	88.4	119.1	83.8	85.6	59.4	51.1

LAMB PRODUCTION OF COARSEWOOL MATINGS CONT.

The table summarizes the lamb production for coarsewool ewes in Research Project III for 1957 and 1958.

The percent of ewes lambing is based on the number of ewes bred, for the year 1937-51. Beginning in 195z this figure is based on number of ewes still present at lambing time. The latter method provides a better indication of fertility by allowing for losses due to death prior to lambing. The percent of lambs born of ewes lambing minus 100 gives the percentage of ewes having twins. From 1937-46 the average weaning weight and pounds of lambs per ewe were based on the weights taken at about 140 days of age and unadjusted for any environmental factors; however in 1947 the weights were adjusted to 120 days and corrected for type of birth, rearing of lamb, and age of dam.

The 1957 coarsewool lamb production is well above that of 1958 is all respects except for percent of lambs born. This would help to explain the better weaning weights and pounds of lambs per ewe for 1957; however the percent of lambs weaned of live lambs born for 1958 is tremendously below the 1957 average.

FACE AND BODY SCORES OF COARSEWOOL WEANLING LAMBS

Year and Breeding Group No.	RAM LAMBS No. of Lambs	Face Covering (score)	Type (score)	Condition (score)	EWE LAMBS No. of Lambs	Face Covering (score)	Type (score)	Condition (score)
1957								
Group								
16	36	2.82	2.37	2.66	37	2.76	2.47	2.58
23	46	3.05	2.39	2.46	27	2.75	2.43	2.51
Total & Averages	82	2.94	2.38	2.56	64	2.75	2.45	2.55
1958								
Group								
16	32	2.86	3.01	3.50	46	2.85	3.00	3.55
23	47	3.05	3.01	3.55	40	2.86	3.00	3.55
Total & Averages	79	2.96	3.01	3.53	86	2.86	3.00	3.55
1957-58 Averages	161	2.95	2.70	3.05	150	2.81	2.73	3.05
1949-56 Averages	1527	2.85	2.68	2.96	1486	2.68	2.74	2.93

The above table summarizes the face and body scores for coarsewool weanling lambs. The scores for 1957 lambs are better in every instance than the 1958 lambs. There is not much difference between the sexes with regard to face and body scores. In most instances the 1957-58 average is slightly inferior to the 19549-56 average.

FLEECE CHARACTERISTICS OF COARSEWOOL WEANLING LAMBS

Year and Breeding Group No.	No. of Lambs	Fiber Diameter (microns)	Grade *	Staple Length	Kemp (percent)	Other Med. Fiber (percent)	Outer-co (score)
1957							
Group							
16	73	30.46	50s	5.94	0.01	2.75	2.44
23	73	26.34	58s	3.67	0.01	0.28	1.57
Total & Averages	146	28.40	56s	4.81	0.01	1.52	2.01
1958							
Group							
16	78	28.06	56s	5.87	0	0.56	1.61
23	85	26.58	58s	4.41	0.18	0.35	1.43
Total & Averages	163	27.32	56s	5.14	0.09	0.46	1.52
1957-58 Averages	309	27.86	56s	4.98	0.05	0.99	1.77
1949-56 Averages	3013	28.28	56s	4.19	0.12	2.29	2.38

* Grade based on ASTM Standards.

The fleece characteristics of coarsewool weanling lambs of Research Project 3 are given above. All traits were measured from the wool sample taken from the side. The 1957 lambs were superior to the 1958 lambs with regard to percent of kemp; however the 1958 lambs excelled the 1957 lambs in staple length, percent medullated fibers, and outer-coat score. The average for both years show a gain in all traits over the 1949-56 lambs.

SELECTION PRACTICED ON COARSEWOOL WEANLING LAMBS

The selection differential, relative emphasis, and expected genetic gain per gneration for weanling lambs in Research Project III are shown in the following table.

The most emphasis has been placed on weaning weight, body type, condition and outer-coat scores. Selection against outer-coat and medullation has resulted in some selection pressure against staple length.

The relative emphasis on each trait at weaning time is computed by multiplying the selection differential by the standards deviation for that trait. The expected genetic gain is figured by multiplying the selection differential by the heritability estimate. The expected genetic gain per generation is an average of the ewes and rams expected genetic gain.

A positive selection differential for weight and staple length is desirable, while a negative figure for the score traits-face, type, condition, color, and outer-coat indicates superiority of the selected animals.

SELECTION PRACTICED ON COARSEWOOL WEANLING LAMBS

Year and Group No.	Sex		Weaning Weight (lbs.)	Staple Length (cms)	Fiber Diameter (microns)	Face Covering (score)	Body Type (score)	Condition (score)	Color (score)	Outer-coat (score)	Percent Saved
1957		Heritability	21%	6%	30%	46% *	4%	11%	-	-	
Group 16	Rams	Selection Differential	6.64	.02	.20	-.11	-.44	-.31	-.33	-.15	54%
		Relative Emphasis	.65	.018	.08	-.225	-.79	-.586	-.324	-.16	
		Expected Genetic Gain	1.39	.001	.06	-.05	-.018	-.034	-	-	
	Ewes	Selection Differential	2.64	-.18	.30	.0	-.34	-.21	-.39	.03	78%
		Relative Emphasis	.27	-.122	.122	-	-.592	-.482	-.375	.032	
		Expected Genetic Gain	.55	-.011	.09	.0	-.014	-.023	-.	-	
	Rams and Ewes	Expected Genetic Gain per Generation	.97	-.005	.075	-.025	-.016	-.029	-	-	
1957											
Group 23	Rams	----------	No Rams Saved in Group 23								
	Ewes	Selection Differential	4.36	-.37	.64	-.41	-.32	-.14	-.50	-.32	89%
		Relative Emphasis	.49	-.319	.32	-.90	-.53	-.163	-.48	-.557	
		Expected Genetic Gain	.92	-.02	.19	-.19	-.013	-.015	-	-	

SELECTION PRACTICED ON COARSEWOOL WEANLING LAMBS

Year and Group No.	Sex		Weaning Weight (lbs.)	Staple Length (cms)	Fiber Diameter (microns)	Face Covering (score)	Body Type (score)	Condition (scores)	Color (score)	Outer-coat (score)	Percent Saved
1958											
Group 16	Rams	Selection Differential	2.20	.13		.064	-.211	-.045	-.15	-.01	44%
		Relative Emphasis	.24	.11		.16	-.419	-.056	-.14	-.025	
		Expected Genetic Gain	.46	.008		.03	-.008	-.005	-	-	
	Ewes	Selection Differential	2.93	-.18		-.14	-.268	-.212	.14	-.19	70%
		Relative Emphasis	.40	-.148		-.364	-.434	-.422	.163	-.398	
		Expected Genetic Gain	.615	-.011		-.066	-.011	-.023	-	-	
	Rams and Ewes	Expected Genetic Gain per Generation	.54	-.002		-.018	-.009	-.014	-	-	
1958											
Group 23	Rams	----------		No Rams Saved in Group 23							
	Ewes	Selection Differential	2.90	-.11		-.08	-.06	-.11	-.21	-.13	74%
		Relative Emphasis	.36	-.087		-.135	-.144	-.236	-.174	-.228	
		Expected Genetic Gain	.61	-.007		-.037	-.002	-.012	-	-	

* Heritability estimate for Face Covering score as obtained for range Targhee and Columbia lambs at Dubois, Idaho.

BODY WEIGHTS AND SCORES OF COARSEWOOL YEARLING RAMS

Year and Breeding Group No.	No. of Rams	Body Weight (lbs.)	Type (score)	Condition (score)	Face Covering (score)	Color (score)	Outer-coat (score)
1957							
Group 16	27	92.8	2.80	3.32	2.28	1.07	1.64
23		No Rams Saved					
Total & Averages	27	92.8	2.80	3.32	2.28	1.07	1.64
1958							
Group 16	17	118.4	3.11	3.32	2.14	1.41	1.47
23		No Rams Saved					
Total & Averages	17	118.4	3.11	3.32	2.14	1.41	1.47
1957-58 Averages	44	105.6	2.96	3.32	2.21	1.24	1.56
1949-56 Averages	398	110.1	2.55	3.32	2.22	1.36	1.74

The above table summarizes the body weights and scores for the yearling coarsewool rams. No rams were saved in group 23 because the rams for this grou are derived from group 16. The body weights for 1958 are considerably better than the yearling body of rams for 1957. Score for color, face covering and outer-coat for 1957-58 have been improved, but the remaining traits show a slight decrease or no change at all.

FLEECE CHARACTERISTICS OF COARSEWOOL YEARLING RAMS

Year and Breeding Group No.	No. of Rams	Fleece Weights Grease (lbs.)	Fleece Weights Clean (lbs.)	Fiber Diameter (microns)	Grade *	Staple Length (cms)	Other Med. Fibers (percent)
1957							
Group 16	28	5.41	3.21	25.61	58s	10.19	0.0
23		No Rams Saved					
Total & Averages	28	5.41	3.21	25.61	58s	10.19	0.0
1958							
Group 16	17	6.11	3.63	27.89	56s	11.69	1.10
23		No Rams Saved					
Total & Averages	17	6.11	3.63	27.89	56s	11.69	1.10
1957-58 Averages	45	5.76	3.42	26.75	58s	10.94	.55
1949-56 Averages	401	7.17	4.67	27.09	58s	11.95	.10

* Grade based on ASTM Standards.

The fleece characteristics for the coarsewool yearling rams are summarized in the above table. Yearling rams for 1957 and 1958 are approximately equal in fleece traits with the exception of the increased medullation for the 1958 yearling rams. The percent yield of clean wool for 1957-58 is about six percent lower than the 1949-56 average.

BODY WEIGHTS AND SCORES OF YEARLING COARSEWOOL EWES

Year and Breeding Group No.	No. of Ewes	Body Weight (lbs.)	Type (score)	Condition (score)	Face Covering (score)	Color (score)	Outer-coat (score)
1957							
Group							
16	45	89.7	2.58	2.25	2.09	1.44	1.76
23	32	87.3	2.67	2.60	2.28	1.47	1.23
Total & Averages	77	88.5	2.63	2.68	2.19	1.46	1.50
1958							
Group							
16	25	88.0	3.22	3.57	2.34	1.31	1.46
23	23	85.5	3.27	3.54	2.21	1.30	1.20
Total & Averages	48	86.8	3.25	3.56	2.28	1.31	1.33
1957-58 Averages	125	87.7	2.94	3.12	2.24	1.39	1.42
1949-56 Averages	971	77.2	2.62	2.72	1.99	1.51	2.21

The score table summarizes body weights and scores of yearling coarsewool ewes. The body weights for 1957 and 1958 are considerably above the 1949-56 averages; however the value for the scored traits are below has been considerable gain in the outer-coat of the coarsewool ewe as is evident from the above table.

FLEECE CHARACTERISTICS OF YEARLING COARSEWOOL EWES

Year and Breeding Group No.	No. of Ewes	Fleece Weights Grease (lbs.)	Fleece Weights Clean (lbs.)	Fiber Diameter (microns)	Grade *	Fiber Traits at Side Staple Length (cms)	Fiber Traits at Side Other Med. Fibers (percent)
1957							
Group							
16	45	6.12	3.53	26.91	58s	10.37	0.30
23	32	5.94	3.09	23.61	62s	8.06	0.0
Total & Averages	77	6.03	3.31	25.26	60s	9.22	0.15
1958							
Group							
16	26	5.68	3.50	26.25	58s	10.07	0.38
23	23	5.23	3.44	24.19	60s	7.47	0.03
Total & Averages	49	5.46	3.47	25.22	60s	8.77	0.21
1957-58 Averages	126	5.75	3.39	25.24	60s	8.99	0.18
1949-56 Averages	970	5.41	3.32	23.44	62s	10.55	0.15

* Grade based on ASTM Standards.

The 1957 yearling coarsewool ewes sheared heavier fleeces but the percent of clean yield is nine percent less than the 1958 clean wool yield. The 1957 and 1958 coarsewool yearling ewes are about equal with references to s staple length and percentage of medullated fibers present. However, the rigid selection practiced to obtain fleeces displaying good uniformity of grade, freedom from kemp, breachiness, medullation has resulted in a certain amount of selection against staple length. Kemp fibers have been so completely eliminated that it is not necessary to include data on kemp percentage in the fleece characteristics table.

RESEARCH PROJECT IV

Development of a more efficient method for selection rams used in the program of the Southwestern Range and Sheep Breeding Laboratory.

This study was made to determine the effect of age of rams in relation to body weight, grease fleece weight, clean fleece weight, and staple length. If age of the ram has an effect on the sbove mentioned traits then adjustments should be made relative to the age of the individual ram when selection is made. These adjustments would tend to put rams of various ages on the basis so that a true comparison could be made during the period of selection. One should not over look the differences in the number of rams for each age group, nor the amount or direction of selection which were practiced on the older rams when interpreting the results in the following table.

Data for this study included 703 rams and were taken during the years 1951 through 1956. Age groups represented were from yearling to six-year-old. The following table shows the adjusted averages for the traits included in the study.

ADJUSTED AVERAGES FOR RAM TRAITS

Age of Rams (years)	No. of Rams	Body Weight (lbs.)	Fleece Weight Grease (lbs.)	Clean Fleece Weight (lbs.)	Staple Length (inches)
1	310	112	7.9	4.3	4.1
2	194	144	11.0	5.8	4.1
3	98	167	12.1	6.8	4.3
4	51	175	11.6	6.5	4.0
5	29	175	11.9	6.3	4.1
6	21	169	11.0	5.6	4.0

The most pronounced effect age had on rams traits was from yearling age to two years old, with the largest increase or gain in these four traits being made in that one year. For rams in this study, staple length was least affected by age, thus little attention is necessary for this trait when selecting among rams of different ages. Large differences were found for body weight, grease fleece weight, and clean fleece weight. After the rams reached three years of age, clean fleece weight and grease fleece weight began declining with each additional year of age. Body weight continued to increase, but the increase was less with each year of age. The peak of production for these rams came at three years of age for all traits except body weight.

The differences due to the age for the traits in the previous table are based on six-year records and are no doubt influenced by the environment of each of these years; therefore the previous differences are not meant to apply to all sheep. However, they do show the importance of adjusting these traits for age. If a selection program is successful and progress is being made, the younger sheep should be better, genetically, than the older sheep. Probably the best method of allowing for differences due to age would be to divide the rams into age groups and make selections within each age group. However, to compare rams of varying ages and in one group, the previous table was devised from records of rams at the Laboratory to facilliate the selection of breeding rams. These rams were of both fine and coarsewool breeds.

In comparing a yearling ram with a three-year-old, one would consult the table and add to the yearling measurements: 55.0 pounds of body weight, 4.2 pounds grease fleece weight, and 2.5 pounds clean fleece weights this total figure would give an indication of what that same ram would produce at three years of age. By making the adjustments for effect of age, one will tend to select the high producing rams even though they may not have attained the age for maximum size. However, as was mentioned previously, one should keep in mind that part of the differences attributed to age are probably due to selection; therefore age changes are probably less than those given if selection is positive. This discrepancy can be estimated by determining the selection differentials at each age and multipling them by the repeatability.